Space Environments and Effects Program

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A hazard to all spacecraft orbiting the Earth is the existence of a harsh environment with its subsequent effects. Some of these environmental hazards, such as plasma, extreme thermal excursions, ionized radiation, and meteoroids result from natural sources. Others, such as orbital debris and neutral contamination are induced by the presence of spacecraft themselves. This subsequently can produce damaging or even disabling effects on spacecraft, its materials, and its instruments. In partnership with industry, academia, and other Government agencies, the Space Environments and Effects (SEE) Program defines the space environments and advocates technology development to accommodate or mitigate these harmful environments on spacecraft; hence the technology is transferred to spacecraft developers for incorporation in design. The SEE Program establishes new plateaus of technical capability to reduce the cost of NASA's science and exploration missions which enables new and more challenging missions. The SEE Program also provides leading-edge exploratory and focused technology to promote continued U.S. preeminence in space. Figure 119 shows the relationship to other space flight programs.

The objectives of the SEE Program are to develop, verify, and transfer space environment and effects technologies that are required to design, manufacture, and operate reliable, cost-effective spacecraft. In order to satisfy these objectives, initial research proposals were solicited through a NASA Research Announcement (NRA) in the areas of engineering environmental definitions, environments and effects guidelines, assessment models and data bases, and flight/ground simulation/technology assessment data. Utilizing a peer review process that included nongovernmental reviewers, 18 proposals were selected for initial funding. Each winning proposal was assigned to a NASA Center based on the residence of the Technical Working Group chairperson for that particular discipline under which the proposal was categorized.

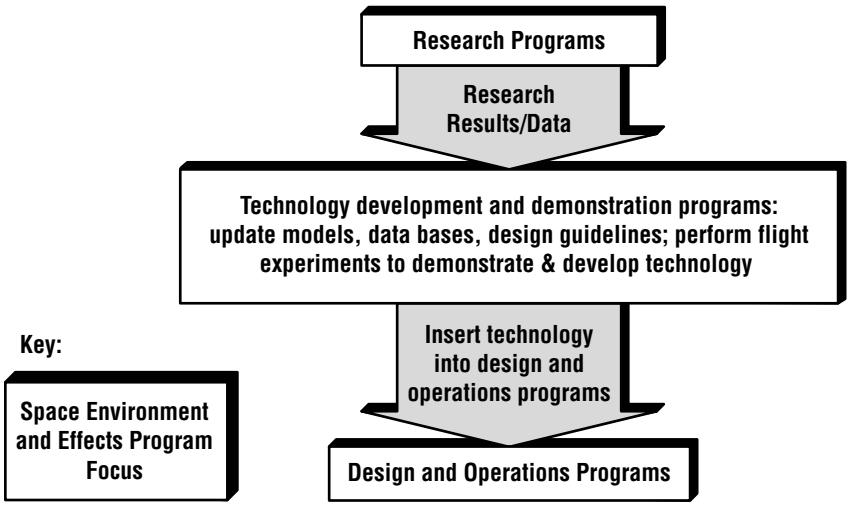

Figure 119.—Relationship to other programs.

Two examples of these technology development activities are as follows:

1) The Ionizing Radiation Environment and its Effects on Satellites.

   This effort developed an improved model of the ionizing radiation environment in space and its effects on satellites. It is a user-friendly computational tool for use by the aerospace community. It estimates single-event effect rates as a guide to:
   - Electronic parts selection for spacecraft; and
   - Demonstrate compliance of a proposed spacecraft design regarding reliability and operability.

2) Development of Design Standards and Guidelines for Electromagnetic Compatibility and Lightning Protection for Spacecraft Utilizing Composite Materials.

   This effort will develop design guidelines relating to electrical bonding, shielding, fault current carrying capability, and lightning protection for aircraft and aerospace vehicles using composite materials. The guidelines will contain the results of the following:
   - Development of a data base that identifies electrical properties of nonmetallic composite materials used on spacecraft, satellites, and aircraft;
   - Results of tests to determine fault carrying current capability of selected materials; and
   - Results of simulated lightning tests to determine effects of high currents especially across joints in composite materials.

Most of the 18 activities are 3 years in duration ending in 1997. As the SEE Program receives the technology deliverables, the program actively pursues the integration of these new technologies into spacecraft design.

Sponsor: Office of Aeronautics

Biographical Sketch: Billy Kauffman is an aerospace engineer working with AST, studying the flight vehicle atmospheric environment. In this position, he plans, coordinates, and participates in engineering research activities as they apply to NASA's SEE Program. Kauffman establishes liaison with management and technical echelons of other laboratories and offices of MSFC, NASA Headquarters, other NASA Centers, government agencies and private industry involved in the SEE Program. He also participates in research studies relative to the improvement of engineering models and guidelines, develops publications and provides forums that aid in the transfer of technical information within the NASA SEE community. Kaufman earned his B.S. degree in mechanical engineering in December 1987 at the University of Alabama in Huntsville.